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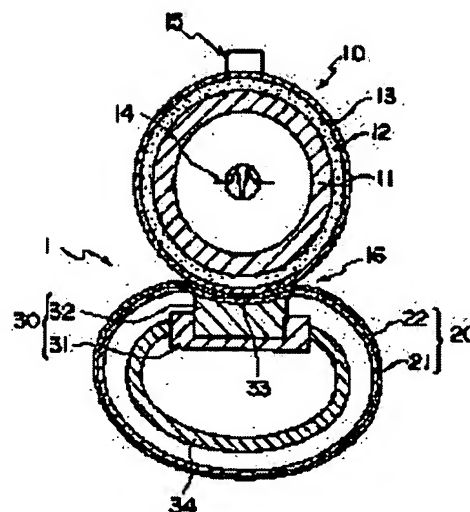
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(54) IMAGE FIXING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image fixing device capable of stably obtaining an image of high quality by securing the stable traveling performance of a belt, without causing reduction in the releasability of a fixing roll.

SOLUTION: The device 1 is provided with a heating/fixing roll 10 rotatably arranged, an endless belt 20 disposed to enable traveling in a contact state with the heating/fixing roll 10 and a pressing pad 30 which is arranged inside the endless belt 20 and for pressing the heating/fixing roll 10 with the endless belt 20, to form a nipping part 16 through which a recording sheet carrying an unfixed toner image can pass, between the endless belt 20 and the heating/fixing roll 10. Modified silicone oil is interposed between the pressing pad 30 and the endless belt 20, as a lubricant. Further, it is preferable that the modified silicone oil is of amino modified silicone oil.



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CLAIMS

[Claim(s)]

[Claim 1] It is arranged inside the heating fixing roll arranged possible [rotation], the endless belt arranged possible [a run], with the aforementioned heating fixing roll contacted, and the aforementioned endless belt. and between the aforementioned endless belt and the aforementioned heating fixing roll So that the nip section which the record sheet holding a non-established toner image can pass may be formed Picture fixing equipment characterized by having come to have the press pad which presses the aforementioned heating fixing roll through the aforementioned endless belt, and making a denaturation silicone oil intervene as lubricant between the aforementioned press pad and the aforementioned endless belt.

[Claim 2] Picture fixing equipment according to claim 1 whose denaturation silicone oil is an amino denaturation silicone oil.

[Claim 3] Picture fixing equipment according to claim 1 or 2 which the front face of a press pad infiltrated the fluororesin into the sheet which knit the glass fiber, and it comes to cover.

[Claim 4] Picture fixing equipment given in either of the claims 1-3 whose denaturation silicone oils are the mixture of the hypoviscosity component 20 whose viscosity in ordinary temperature is 50-300cs - 80 weight sections, and the hyperviscous component 80 whose viscosity in ordinary temperature is 300-100,000cs - 20 weight sections.

[Claim 5] Picture fixing equipment given in either of the claims 1-4 these release agents of whose it comes further to have a release agent supply means to supply a release agent to a heating fixing roll front face, and are lubricant and a denaturation silicone oil of the same kind.

[Claim 6] Picture fixing equipment according to claim 5 with the viscosity smaller than the viscosity in the ordinary temperature of a release agent in the ordinary temperature of a denaturation silicone oil.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the picture fixing equipment of a belt nip method especially about the so-called heating fixing type picture fixing equipment which carries out contact heating fixing of the non-established toner image on a record sheet in the image information recording device using electrophotography methods, such as an electrophotography copying machine, a printer, and facsimile.

[0002]

[Description of the Prior Art] In the former, the heating pressure-roll type thing which performs heating fixing was in use by making the nip section between the heating fixing roll 10 by which was held free [rotation] by bearing, respectively and the pressure welding was mutually carried out like the picture fixing equipment 1 shown, for example in drawing 8 and with which the couple was heated, and a pressure roll 40 pass the record sheet which supported the non-established toner image.

[0003] The elastic layer 12 by HTV (High Temperature Vulcanization) silicone rubber etc. is formed in the peripheral face of the core 11 made from aluminum in the air, and, as for the heating fixing roll 10, it comes to form the mold release layer 13 by RTV (Room Temperature Vulcanization) silicone rubber etc. in the front face of this elastic layer 12. Into the core 11 made from aluminum, the halogen lamp 14 is inserted as a heat source, and the thermo-sensitive devices 15, such as a thermistor, are contacted by the front face of the heating fixing roll 10. The elastic layers 42, such as silicone rubber, are formed in the peripheral face of the metal core 41, and, as for the pressure roll 20, it comes to form the mold release layers 42, such as PFA and PTFE, in the front face of this elastic layer 42. In this conventional picture fixing equipment, the nip section which a record sheet can pass is formed by carrying out the pressure welding of the pressure roll 40 with the predetermined press force with the pressurization spring which is not illustrated to the heating fixing roll 10.

[0004] A rotation drive is carried out at the rate of predetermined by the drive system which is not illustrated, and the heating fixing roll 10 follows and rotates the pressure roll 40 on the heating fixing roll 10. A halogen heater 14 generates heat by energization from an AC power, and the heating fixing roll 10 is heated. The temperature of the heating fixing roll 10 is measured by the thermo-sensitive device 15, and is controlled by predetermined temperature by the temperature-control circuit which is not illustrated. And the record sheet which supported the non-established toner picture is conveyed, and it advances into the nip section 16 between the heating fixing roll 10 and the pressure roll 20. In the nip section 16, a non-established toner picture is fused with heat and a pressure, and heating fixing is carried out at a record sheet.

[0005] However, since in the case of the heating pressure-roll type picture fixing equipment in such the former the elastic layer of either a heating fixing roll or a pressure roll and both is made to deform and the nip section is formed, there are the following problems. That is, in order to form the nip section more than a certain predetermined width of face, the elastic body layer of either a fixing roll or a pressure roll and both must be made comparatively thick, and the press force during these rolls must be enlarged.

This leads to large heat-capacity-ization of the elastic body layer of a fixing roll and heavy-gage-izing of a core, and a fixing roll. If it puts in another way, there is a problem that time (a "worm uptime" is called below) until it raises a fixing roll to the temperature which can be established from a room temperature will become long.

[0006] Then, in order to solve the problem in this former, the artificers of this invention have proposed the picture fixing equipment 1 of a belt nip method using the press pad 30 and an endless belt 20 as shown in drawing 1 (JP,8-262903,A). In this picture fixing equipment 1, the heating fixing roll 10 is the same as the heating fixing roll 10 in the former mentioned above, and it does not have the pressure roll [as / in the conventional heating pressure-roll type picture fixing equipment shown in drawing 8] 40, and has the endless belt 20 instead. The pressure welding of the endless belt 20 is carried out to the front face of the heating fixing roll 10 with the press pad 30 arranged at the inside.

[0007]

[Problem(s) to be Solved by the Invention] However, the picture fixing equipment of the belt nip method which slides the inner skin and the press pad of an endless belt using such an endless belt is not enough in respect of the following. Namely, (1) If coefficient of friction of the inner skin of an endless belt and a press pad is large, the driving torque of a fixing roll will become large. Consequently, the stress committed in the gear receptacle section of the fixing roll core of thin meat becomes large, and causes breakage of a gear or a core. Moreover, the burden to a motor also becomes large with a natural thing.

(2) If it becomes so large that frictional force between a belt and a press pad cannot ignore compared with the driving force of a belt with a fixing roll, a slip will arise between a fixing roll and a belt. If it lets the record sheet which supported the non-established toner image with the bottom of the conditions which a slip produces pass in the nip section, this slip will cause a gap of a picture in the non-established toner image on a record sheet.

(3) In order to make small coefficient of friction between an endless belt and a press pad, it is possible to apply lubricant. However, when grease etc. is used for lubricant, or grease turns and it adheres to a fixing roll, it mixes in a release agent and worsening the mold-release characteristic of a toner may arise.

[0008] Without solving many problems in the aforementioned former and causing the mold-release characteristic fall of a fixing roll, this invention can secure the stable performance-traverse ability of a belt, and aims at offering the picture fixing equipment obtained by being stabilized in a quality picture.

[0009]

[Means for Solving the Problem] The aforementioned The means for solving a technical problem is as follows. Namely, <1> The heating fixing roll arranged possible [rotation] and the endless belt arranged possible [a run], with the aforementioned heating fixing roll contacted, It is arranged inside the aforementioned endless belt. and between the aforementioned endless belt and the aforementioned heating fixing roll So that the nip section which the record sheet holding a non-established toner image can pass may be formed It is picture fixing equipment characterized by having come to have the press pad which presses the aforementioned heating fixing roll through the aforementioned endless belt, and making a denaturation silicone oil intervene as lubricant between the aforementioned press pad and the aforementioned endless belt.

<2> A denaturation silicone oil is picture fixing equipment given in the above <1> which is an amino denaturation silicone oil.

<3> The front face of a press pad is picture fixing equipment the above <1> which infiltrated the fluororesin into the sheet which knit the glass fiber, and it comes to cover, or given in <2>.

<4> A denaturation silicone oil is picture fixing equipment given in either of the above <1> to <3> which is the mixture of the hypoviscosity component 20 whose viscosity in ordinary temperature is 50-300cs - 80 weight sections, and the hyperviscous component 80 whose viscosity in ordinary temperature is 300-100,000cs - 20 weight sections.

<5> It comes further to have a release agent supply means to supply a release agent to a heating fixing roll front face, and is picture fixing equipment given in either of the above <1> these release agents of

whose are lubricant and a denaturation silicone oil of the same kind to <4>.

<6> It is picture fixing equipment given in the above <5> with the viscosity smaller than the viscosity in the ordinary temperature of a release agent in the ordinary temperature of a denaturation silicone oil.

[0010]

[Embodiments of the Invention] The picture fixing equipment of this invention may be equipped with the means, for example, release agent supply means etc., of others which came to have a heating fixing roll, an endless belt, and a press pad at least, and were chosen suitably if needed etc.

[0011] As the aforementioned heating fixing roll, it is attached to the configuration, structure, a size, etc., and there is nothing and especially a limit can be used in itself according to the purpose, choosing it suitably from well-known things. Generally, the aforementioned heating fixing roll has a cylinder-like core and the elastic layer formed in the front face, and comes to prepare the source of heating for the interior of a core.

[0012] Although it excels in a mechanical strength, and there will be especially no limit as the quality of the material of the aforementioned core if heat-conducting characteristic is the good quality of the material, metals, such as aluminum, SUS, iron, and copper, an alloy, ceramics, FRM, etc. are mentioned, for example.

[0013] Although it can choose suitably as the quality of the material of the aforementioned elastic layer from the things of the quality of the material well-known as this elastic layer, silicone rubber, a fluororubber, etc. are mentioned, for example. In this invention, surface tension is small also in these quality of the materials, and silicone rubber is desirable at the point of excelling in elasticity. As this silicone rubber, RTV silicone rubber, HTV silicone rubber, etc. are mentioned, and, specifically, poly dimethyl silicone rubber (MQ), methyl vinyl silicone rubber (VMQ), methylphenyl silicone rubber (PMQ), fluoro silicone rubber (FVMQ), etc. are mentioned, for example.

[0014] As thickness of the aforementioned elastic layer, usually, it is 3mm or less and is 0.5-1.5mm preferably. As a method of forming the aforementioned elastic layer in the front face of the aforementioned core, there is especially no limit, for example, it can adopt the well-known coating method etc. in itself. As the aforementioned coating method, kneader coating, bar coating, curtain coating, spin coating, DIP coating, etc. are mentioned, for example. In this invention, DIP coating can adopt suitably also in these.

[0015] The mold release layer may be formed in the front face of the aforementioned elastic layer in this invention. If the aforementioned mold release layer is formed, it is advantageous at the point that picture fixing equipment can be operated in the state where could prevent offset of a toner image suitably and it was stabilized. If a moderate mold-release characteristic is shown to a toner image as the quality of the material of the aforementioned mold release layer, there will be especially no limit, for example, a fluororubber, silicone rubber, a fluororesin, etc. will be mentioned. A fluororubber is suitably mentioned also in these quality of the materials. As the aforementioned fluororubber, fluoride vinylidene system rubber, fluoro silicone system rubber, tetrafluoroethylene propylene system rubber, fluoro force FAZEN system rubber, tetrafluoroethylene-perfluoro vinyl ether system (perfluoro system) rubber, etc. are mentioned, for example.

[0016] As thickness of the aforementioned mold release layer, usually, it is 10-100 micrometers and is 20-30 micrometers preferably. As a method of forming the aforementioned mold release layer in the front face of the aforementioned core, the coating method which especially a limit does not have, for example, was mentioned above is mentioned. In this invention, DIP coating can adopt suitably also in these.

[0017] Although there is especially no limit and it can choose suitably according to the purpose if it is the thing of a configuration and structure which can be held in the interior of the aforementioned core as the aforementioned source of heating, a halogen heater etc. is mentioned, for example. The skin temperature of the heating fixing roll heated by the aforementioned source of heating can be measured by the thermo-sensitive device prepared for example, in this heating fixing roll, and can control the temperature by control means uniformly. As the aforementioned thermo-sensitive device, there is especially no limit, for example, a thermistor, a thermo sensor, etc. are mentioned. As the

aforementioned control means, there is especially no limit, for example, a temperature controller, a computer, etc. are mentioned.

[0018] As the aforementioned endless belt, there is especially no limit about the configuration and a size, and according to the purpose, it can be used in itself, choosing suitably from well-known things. The belt formed band-like and endless as the aforementioned endless belt is common. As structure of the aforementioned endless belt, you may be monolayer structure and may be multilayer structure. As an endless belt of the aforementioned multilayer structure, what has a base layer and a mold release layer at least is mentioned.

[0019] As the quality of the material of the aforementioned endless belt, a thermosetting polyimide, a thermoplastic polyimide, a polyamide, polyamidoimide **, etc. are mentioned, for example. A thermosetting polyimide is desirable at the point of excelling in thermal resistance, abrasion resistance, chemical resistance, etc. also in these. As the quality of the material of the aforementioned mold release layer, for example A perfluoro alkoxy fluororesin (PFA), A polytetrafluoroethylene (PTFE), a tetrafluoroethylene hexafluoropropylene copolymer (FEP), A polyethylene tetrafluoroethylene (ETFE), a polyvinylidene fluoride (PVDF), Fluororesins, such as poly chloro 3 ethylene fluoride (PCTFE) and a fluoride vinyl (PVF), Poly dimethyl silicone rubber (MQ), methyl vinyl silicone rubber (VMQ), Silicone rubber, such as methylphenyl silicone rubber (PMQ) and fluoro silicone rubber (FVMQ), Fluororubbers, such as fluoride vinylidene system rubber, tetrafluoroethylene-propylene system rubber, fluoro phosphazene system rubber, and tetrafluoroethylene-perfluoro vinyl ether system rubber, etc. are mentioned. When the aforementioned endless belt is the thing of multilayer structure which comes to have a mold release layer and the quality of the material of this mold release layer is the aforementioned fluororesin, since this endless belt is rich in the mold-release characteristic over a toner image, it is advantageous at the point that it becomes unnecessary to use a release agent.

[0020] The aforementioned press pad presses the aforementioned heating fixing roll through this endless belt so that the nip section which the record sheet which is arranged inside the aforementioned endless belt and holds a non-established toner image between this endless belt and the aforementioned heating fixing roll can pass may be formed. As the aforementioned press pad, it is arranged inside the aforementioned endless belt and the aforementioned heating fixing roll is pressed through this endless belt, if it has the function which can form the nip section which the record sheet holding a non-established toner image can pass between this endless belt and the aforementioned heating fixing roll, there is nothing and especially a limit can choose from well-known things suitably according to the purpose.

[0021] There is especially no limit about the configuration of the aforementioned press pad, structure, and a size, and it can choose suitably according to the purpose. For example, the aforementioned press pad may be structure which consists of a single member, and may be structure which consists of two or more members which have a different function. In this invention, the mode with which the front face of the aforementioned press pad infiltrated the aforementioned fluororesin into the sheet which knit fiber, and is covered is desirable. In this case, it is advantageous at the point that heating fixing of a picture can be performed to stability for a long period of time, this press pad being excellent in a mold-release characteristic and endurance, and preventing offset. In addition, as the aforementioned fiber, for example, a glass fiber, a carbon fiber, etc. are mentioned, and a glass fiber is desirable in respect of abrasion resistance especially.

[0022] Here, if it explains referring to drawing 1 and drawing 2 about an example of a press pad, this press pad 30 will come to have the low friction film 33 stretched by the contact surface of a base material 31, the elastic body 32 arranged on a base material 31, and the inner skin of the endless belt 20 in an elastic body 32, and the belt run guide 34 prepared so that an endless belt 20 might rotate smoothly. In addition, the rib of the hand of cut of an endless belt is prepared in the front face of the belt run guide 34, and the touch area with the inner skin of an endless belt 20 is lessened. the collar (flange) which regulates the approach of an endless belt 20 in the ends of the belt run guide 34 -- the member (not shown) of a ** is prepared As the quality of the material of an elastic body 32, silicone rubber, a fluororubber, etc. are mentioned, for example. As a low friction film 33, the glass fiber sheet into which

fluororesins, such as Teflon resin, were infiltrated is mentioned, for example.

[0023] The press pad 30 is pressing the heating fixing roll 10 by the fixed load by energization members, such as a compression coil spring, through an endless belt 20. If it puts in another way, the press pad 30 is pressed by the heating fixing roll 10 by the fixed load by energization members, such as a compression coil spring, through the endless belt 20. As a contact angle of the endless belt 20 to the heating fixing roll 10, it is about 25-40 degrees, and the width of face of a nip 16 is set to about 6-10mm at this time. If the motor which is the driving source of the heating fixing roll 10 is driven, the heating fixing roll 10 will carry out a rotation drive. It follows to the rotation drive of this heating fixing roll 10, and the thin film-like endless belt 20 rotates at a fixed speed.

[0024] In this invention, a denaturation silicone oil is given as lubricant between the front face of the aforementioned press pad, and the inside of the aforementioned endless belt. As a method of giving the denaturation silicone oil as the aforementioned lubricant between the front face of the aforementioned press pad, and the inside of the aforementioned endless belt, there is especially no limit and hand control can perform it automatically using a well-known method and equipment in itself.

[0025] In this invention, the aforementioned denaturation silicone oil may be used by the one-sort independent, and two or more sorts may be used together. In the case of the latter, the denaturation silicone oil which is the mixture of the hypoviscosity component 20 whose viscosity in ordinary temperature is 50-300cs - 80 weight sections, and the hyperviscous component 80 whose viscosity in ordinary temperature is 300-100,000cs - 20 weight sections is desirable preferably [using together a denaturation silicone oil of the same kind] and more preferably. If the denaturation silicone oil of such mixture is used, it is advantageous at the point which can control a starting torque and driving torque uniformly in the low range. As the aforementioned denaturation silicone oil, an amino denaturation silicone oil, a carboxy denaturation silicone oil, a sulfonic-acid denaturation silicone oil, etc. are mentioned, for example. An amino denaturation silicone oil is desirable in respect of being able to maintain effectively the starting torque and driving torque of picture fixing equipment in the low range of desired, and excelling in handling nature also in these, etc.

[0026] As long as it has the function which supplies a release agent to the aforementioned heating fixing roll front face as the aforementioned release agent supply means, there is especially no limit and it can be suitably chosen from well-known things according to the purpose. In this invention, as the aforementioned release agent, it is desirable to choose the aforementioned denaturation silicone oil, and it is more desirable to choose the denaturation silicone oil as the aforementioned lubricant and a denaturation silicone oil of the same kind. Thus, when the denaturation silicone oil as the aforementioned lubricant and a denaturation silicone oil of the same kind are chosen, it is advantageous at the point that a mold-release characteristic does not fall even if this release agent and this lubricant are mixed mutually. Furthermore, it is desirable especially to choose a denaturation silicone oil with the viscosity smaller than the viscosity in the ordinary temperature of the denaturation silicone oil as a release agent in the ordinary temperature as the aforementioned release agent in this invention. In this case, it is advantageous at the point which a slip of the aforementioned endless belt can be made hard to generate.

[0027] In the picture fixing equipment of this invention, the aforementioned heating fixing roll is arranged possible [rotation]. The aforementioned endless belt is arranged possible [a run], while a part of the peripheral face had contacted the aforementioned heating fixing roll. The aforementioned heating fixing roll is pressed through the aforementioned endless belt so that the nip section which the record sheet to which the aforementioned press pad is arranged inside the aforementioned endless belt, and holds a non-established toner image between the aforementioned endless belt and the aforementioned heating fixing roll can pass may be formed. And between the aforementioned press pad and the aforementioned endless belt, the denaturation silicone oil intervenes as lubricant.

[0028] Therefore, if the aforementioned heating fixing roll carries out a rotation drive, it will follow to the rotation drive of this heating fixing roll, and the aforementioned endless belt will also rotate. If the record sheet holding a non-established toner image exists in the entrance of the nip section formed between the aforementioned heating fixing roll and the aforementioned endless belt at this time, this

record sheet will be incorporated by the aforementioned nip section, and will pass this nip section. The aforementioned record sheet is pressed and heated in this nip section by the aforementioned heating fixing roll and the endless belt pressed with the aforementioned press pad at the aforementioned heating fixing roll side. Consequently, heating fixing of the toner image on this record sheet is carried out on record sheet.

[0029] When the release agent is given between this toner image and the aforementioned heating fixing roll at this time, defects, such as offset by a toner image and a heating fixing roll adhering, do not arise. On the other hand, without being generated in the fault of a slip etc. to rotation of the aforementioned heating fixing roll and rotation of the aforementioned endless belt, since the denaturation silicone oil as the aforementioned lubricant intervenes between the aforementioned endless belt and the aforementioned press pad, a smooth rotation drive is collateralized and heating fixing of a smooth picture can be carried out repeatedly.

[0030]

[Example] Although the example of this invention is explained below, this invention is not limited to these examples at all.

[0031] (Example 1) With reference to drawing 1 and drawing 2, the example of this invention is explained hereafter. The picture fixing equipment 1 shown in drawing 1 and drawing 2 is equipped with the heating fixing roll 10, the thin film-like endless belt 20, and the press pad 30. An endless belt 20 is pressed by the heating fixing roll 10 with the press pad 30 arranged at the inside, the pressure welding is carried out to this endless belt 20, and the nip section 16 which a record sheet can pass is formed between the heating fixing roll 10 and the endless belt 20.

[0032] The heating fixing roll 10 is covered by the thickness of 500 micrometers as an elastic layer 12 in silicone HTV rubber (45 rubber degrees-of-hardness JIS-A), it comes to carry out the DIP coat of it to the thickness whose fluororubber is 30 micrometers on the front face of this elastic layer 12 as a mold release layer 13, and the peripheral face of the core 11 iron by the shape of a cylinder with the outer diameter of 30mm, a thickness, and a length of 360mm is made to it by the front face near a mirror-plane. The halogen lamp 14 of 600w is arranged in the interior of a core 11 as a source of heating. The skin temperature of the heating fixing roll 10 was controlled by the thermo sensor of the thermo-sensitive device 15 arranged where the front face of this heating fixing roll 10 is contacted, and the temperature controller which is not illustrated by 150 degrees C. Moreover, the amino denaturation silicone oil of viscosity 300CS was uniformly supplied to the front face of the mold release layer 13 of the heating fixing roll 10 by the oil distribution system (not shown) as a release agent.

[0033] An endless belt 20 makes a thermosetting polyimide with the circumference of 94mm, a thickness [of 75 micrometers], and a length of 320mm a base material 21, coats the peripheral face of this base material 21 with a perfluoro alkoxy fluororesin (PFA) at the thickness of 30 micrometers, and comes to form the mold release layer 22.

[0034] The press pad 30 consists of a low friction film 22 stretched by the contact surface of a base material 31, the elastic body 32 arranged on a base material 31, and the endless belt 20 of an elastic body 32, and a belt run guide 34 prepared so that an endless belt 20 might rotate smoothly. An elastic body 52 is silicone rubber with width of face of 10mm, a thickness [of 5mm], and a length of 320mm, and the low friction film 33 arranged on the front face is the glass fiber sheet into which Teflon resin was infiltrated. The rib of a belt hand of cut is prepared in the front face of the belt run guide 34, and the touch area with the inner skin of an endless belt 20 is lessened. the collar (flange) which regulates the approach of an endless belt 20 in the ends of the belt run guide 34 -- the member (not shown) of a ** is prepared. A base material 31 is thermal resistance and has the function which fixes an elastic body 32. This base material 31 is pressing the heating fixing roll 10 by the 30kg load by the compression coil spring (not shown) through the thin film-like endless belt 20.

[0035] The contact angle of the endless belt 20 to the heating fixing roll 10 was about 40 degrees, and the width of face of the nip section 16 was about 10mm at this time. The driving force from a motor was transmitted to the heating fixing roll 10, and the heating fixing roll 10 and the endless belt 20 rotated at the rate of 160 mm/sec.

[0036] The glass fiber sheet (FGF-400-4) which infiltrated the Teflon by Restoration Chemicals Industrial company into press pad 30 front face as a low friction sheet 33 is covered. Between the front face of the press pad 30, and the inside of an endless belt 20, the amino denaturation silicone oil intervenes as lubricant. In an example 1, since the lubricant to be used is the release agent supplied to the heating fixing roll 10, and oil of the same kind, even if a release agent and lubricant are mixed, the problem that mold release is poor is not produced.

[0037] Here, the viscosity of an amino denaturation silicone oil and the rotational speed of the heating fixing roll 10 were changed, and the driving torque of the heating fixing roll 10 was measured. The result was shown in drawing 3 -5. In addition, in these drawings, since the aforementioned driving torque has a dynamic friction coefficient and a fixed correlation, namely, there is a correlation of the driving torque $1 \text{ kg-cm} = \text{dynamical friction force (coefficient)} 0.022$, it is possible that the aforementioned driving torque means the sliding friction between endless-belt 20 inside and low friction sheet 33 front face in the press pad 30. Moreover, a starting torque is shown when the rotational speed of the heating fixing roll 10 is zero.

[0038] From the graph of drawing 3, when the viscosity of the amino denaturation silicone oil as lubricant is high (10,000CS), i.e., rotating a heating fixing roll at the speed which the fluidity carried out slowly at the low case, since it becomes easy to be placed between the interfaces of an endless belt 20 and the press pad 30 by the amino denaturation silicone oil, it is effective in reducing driving torque, and a starting torque also becomes small. However, when rotating the heating fixing roll 10 at high speed, since an amino denaturation silicone oil is hyperviscosity, torque also increases with speed.

[0039] On the other hand, if oil becomes easy to dry up and the heating fixing roll is rotated at a low speed when the viscosity of a low (100CS), i.e., a fluidity, of the amino denaturation silicone oil as lubricant is high, an amino denaturation silicone oil will stop being able to go into the nip section 16 easily. Therefore, at a low speed, driving torque becomes large and a starting torque also becomes large. However, if high-speed, it is stabilized and torque becomes small.

[0040] It became clear that two curves cross [oil viscosity] here in about 300 CS as shown in drawing 4 when the relation to the oil viscosity of a starting torque and the driving torque at the time of fixing speed 160 mm/s is investigated. The relation between the torque of the amino denaturation silicone oil of this 300CS and the torque of a dimethyl silicone oil was shown in drawing 5. Compared with the dimethyl silicone oil, there were few both speed dependencies, and since an amino denaturation silicone oil had a denaturation machine, it was easy to make a coat to a belt inside, and the bird clapper became [torque] generally small clearly.

[0041] From such a viewpoint, the amino denaturation silicone oil of the viscosity which is about 300 CS which two torque curves cross is made to intervene between the press pad 30 and an endless belt 20, and the driving torque of the heating fixing roll 10, i.e., the sliding force of the inner skin of an endless belt 20 and the press pad 30, is made small.

[0042] In order to reduce torque furthermore, it became clear that what is necessary is just to mix the hyperviscous oil which is effective in reducing a starting torque, and the hypoviscosity oil which driving torque. For example, as shown in drawing 6, taking advantage of both advantages, a starting torque and driving torque were able to be simultaneously made small by mixing the amino denaturation silicone oil whose viscosity is 100CS, and the amino denaturation silicone oil whose viscosity is 10,000Cs. Compared with the case where the amino denaturation silicone oil whose viscosity is 300CS is specifically independently used in this case, the starting torque was able to be made small.

[0043] Moreover, in the combination of the amino denaturation silicone oil whose viscosity is 100CS, and the amino denaturation silicone oil whose viscosity is 300CS, the driving torque by the side of high speed has been reduced compared with the case where it is used by the amino denaturation silicone-oil independent independent viscosity is 300CS.

[0044] In an example 1, although the amino denaturation silicone oil as a release agent is supplied in order to raise a toner mold-release characteristic also on the front face of the heating fixing roll 10, if the amount of amino denaturation silicone oils as this release agent increases, the frictional force of the heating fixing roll 10 and the peripheral face of an endless belt 20 will become small, and a slip will

become easy to take place.

[0045] Here, the result as shown in ***** which investigated the relation between the amount of amino denaturation silicone oils as a release agent given to the front face of the heating fixing roll 10 and the speed of the endless belt at the time of changing torque, and drawing 7 was obtained. The heating fixing roll 10 was rotated at the rate of 160 mm/s. The thick line showed the field which a slip begins to produce between the heating fixing roll 10 and an endless belt 20.

[0046] Moreover, the result which changed the viscosity of the amino denaturation silicone oil as a release agent supplied to the heating fixing roll 10, and investigated the behavior of a slip of an endless belt 20 was shown in drawing 8. When the viscosity of the amino denaturation silicone oil as a release agent by the side of the heating fixing roll 10 became smaller than the viscosity of the amino denaturation silicone oil as lubricant given to the inside of an endless belt 20, being easy of a bird clapper became generating a slip of an endless belt 20 also in low torque and the amount of low oil clearly. On the contrary, when the viscosity of the amino denaturation silicone oil as a release agent made it larger than the viscosity of lubricant, the bird clapper became clear that it is hard to produce a slip of an endless belt 20.

[0047] In an example 1, driving torque is about 2-3 kg-cm, and since the amount of the amino denaturation silicone oil as a release agent is 1-5microl/A4, a slip of an endless belt 20 is not produced.

[0048] (Example 2) In the example 1, outside which changed the following points was performed like the example 1. That is, the mold release layer 13 of the heating fixing roll 10 in an example 1 was changed into the mold release layer 13 of a fluororesin tube with a thickness of 30 micrometers. Moreover, the mold release layer 22 of an endless belt 20 was changed into the mold release layer 22 of silicone LTV rubber with a thickness of 50 micrometers. And the same result as an example 1 was obtained. That is, by making the amino denaturation silicone oil whose viscosity is 300CS intervene as lubricant between the front face of the press pad 30, and the inside of an endless belt 20, like the example 1, the frictional force of the press pad 30 and the inner skin of an endless belt 20 was able to be reduced, and smooth picture fixing was able to be performed.

[0049]

[Effect of the Invention] Without according to this invention, being able to solve many problems in the aforementioned former and causing the mold-release characteristic fall of a fixing roll, the stable performance-traverse ability of a belt can be secured and the picture fixing equipment obtained by being stabilized in a quality picture can be offered. The starting torque and driving torque of the heating fixing roll resulting from the frictional force of the inner skin of an endless belt and a press pad can more specifically be reduced effectively, stress by which a load is carried out to the core, especially gear portion of a heating fixing roll can be effectively made small, and breakage of a core etc. can be prevented. Moreover, since own torque of a motor can also be made small, curtailment of operation cost can also be aimed at. Furthermore, picture fixing can be performed smoothly, without causing a gap of a picture and disorder, even when it lets the record sheet which a slip of an endless belt stops generating and holds a non-established toner picture by making small frictional force of the inner skin of an endless belt, and a press pad pass in the nip section.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is cross-section outline explanatory drawing for explaining one example of the picture fixing equipment of this invention.

[Drawing 2] Drawing 2 is tropia outline explanatory drawing for explaining one example of the picture fixing equipment of this invention.

[Drawing 3] Drawing 3 is a graph which shows the relation of the torque of a heating fixing roll and rotational speed about an amino denaturation silicone oil.

[Drawing 4] Drawing 4 is a graph which shows the relation of the driving torque of a heating fixing roll and the viscosity of an amino denaturation silicone oil at the time of fixing driving torque.

[Drawing 5] Drawing 5 is a graph which shows the relation between the torque of the heating fixing roll seen about the dimethyl silicone oil and the amino denaturation silicone oil, and rotational speed.

[Drawing 6] Drawing 6 is a graph which shows the relation between the torque of the heating fixing roll seen about an amino denaturation silicone-oil independent and combination, and rotational speed.

[Drawing 7] Drawing 7 is a graph which shows the relation between the torque of the heating fixing roll seen about the slip of an endless belt, and the amount of an amino denaturation silicone oil, when rotating a heating fixing roll at a fixed speed.

[Drawing 8] Drawing 8 is a graph which shows the relation between the torque of the heating fixing roll seen about the slip of an endless belt, and the amount of an amino denaturation silicone oil, when the viscosity of an amino denaturation silicone oil is made to change.

[Drawing 9] Drawing 9 is cross-section outline explanatory drawing showing an example of conventional heating pressure-roll type picture fixing equipment.

[Description of Notations]

- 1 Picture Fixing Equipment
- 10 Heating Fixing Roll
- 11 Core
- 12 Elastic Layer
- 13 Mold Release Layer
- 14 Halogen Lamp
- 15 Thermo-sensitive Device
- 16 Nip Section
- 20 Endless Belt
- 21 Base Material
- 22 Mold Release Layer
- 30 Press Pad
- 31 Base Material
- 32 Elastic Body
- 33 Low Friction Film
- 34 Belt Run Guide

40 Pressure Roll
41 Core
42 Elastic Layer

[Translation done.]

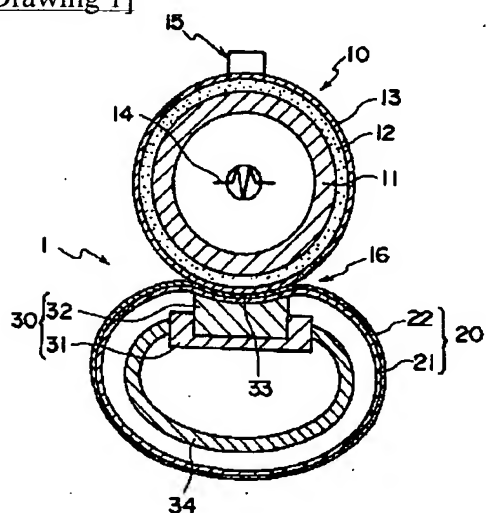
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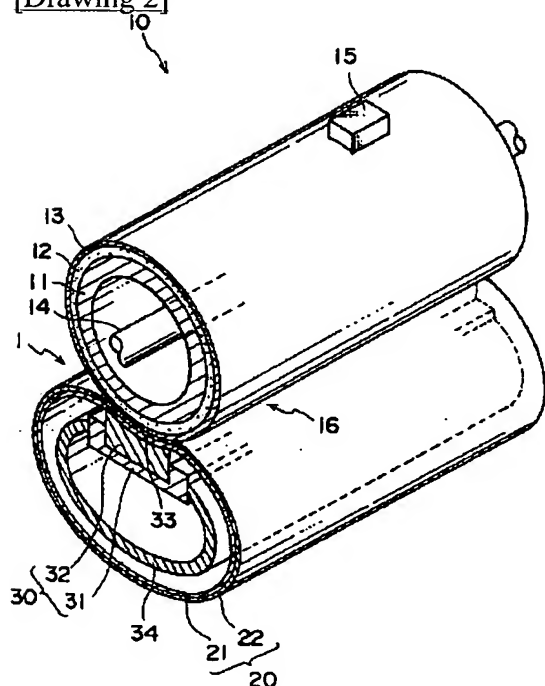
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DRAWINGS

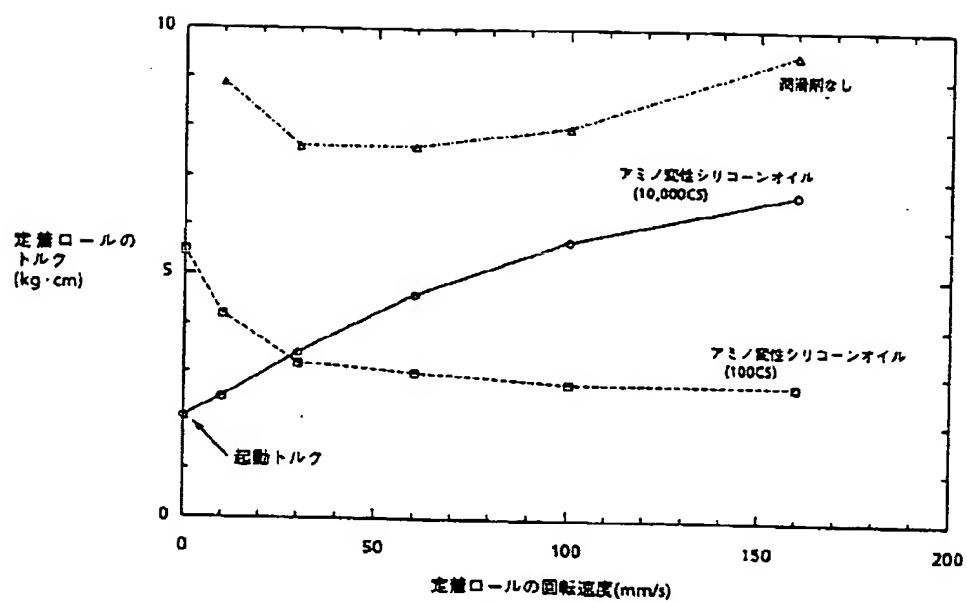
[Drawing 1]



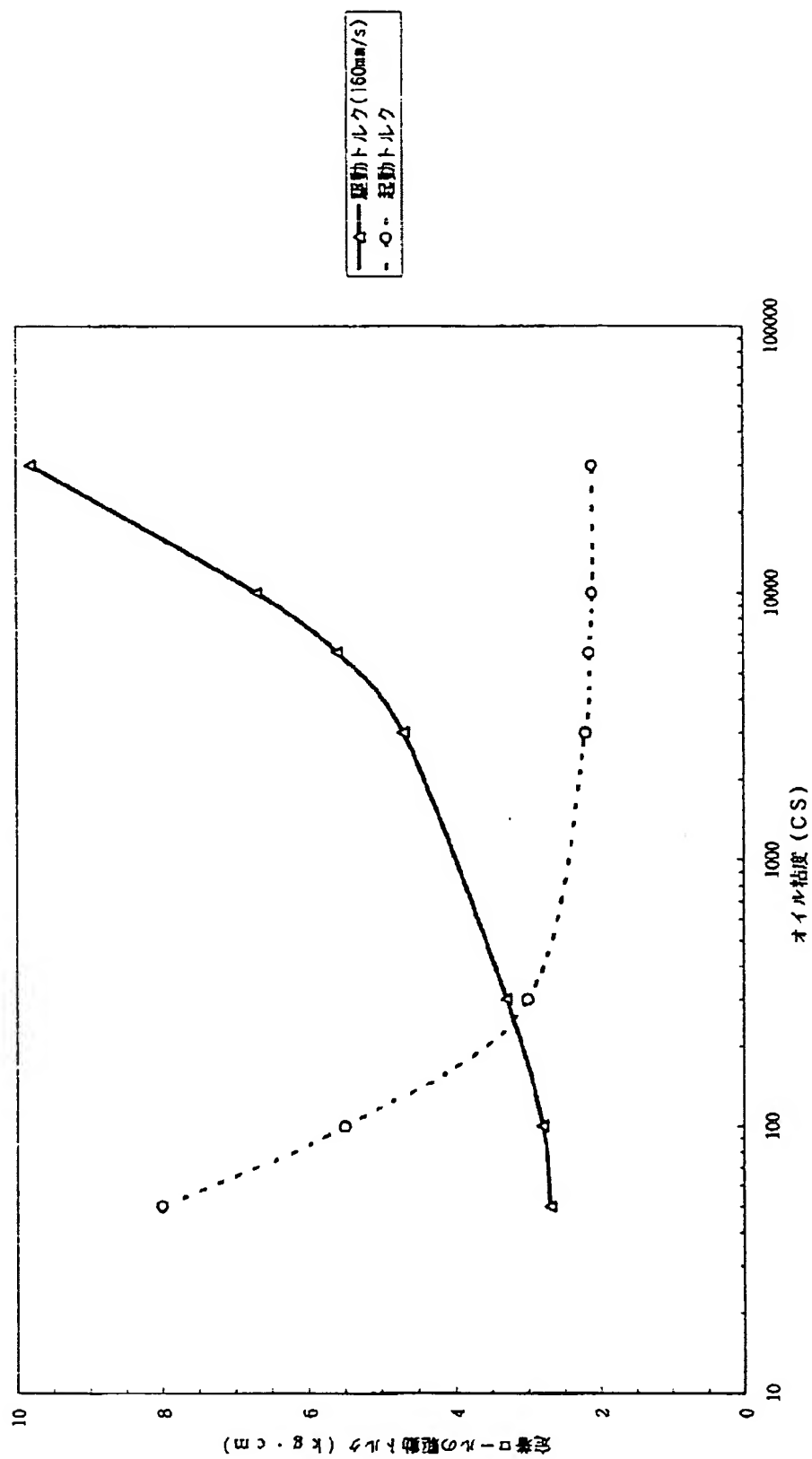
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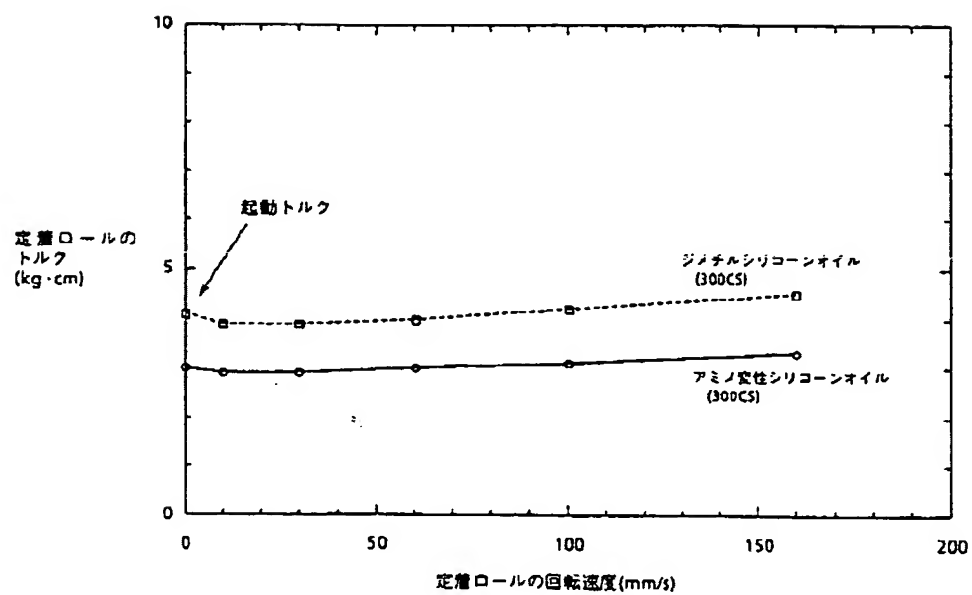
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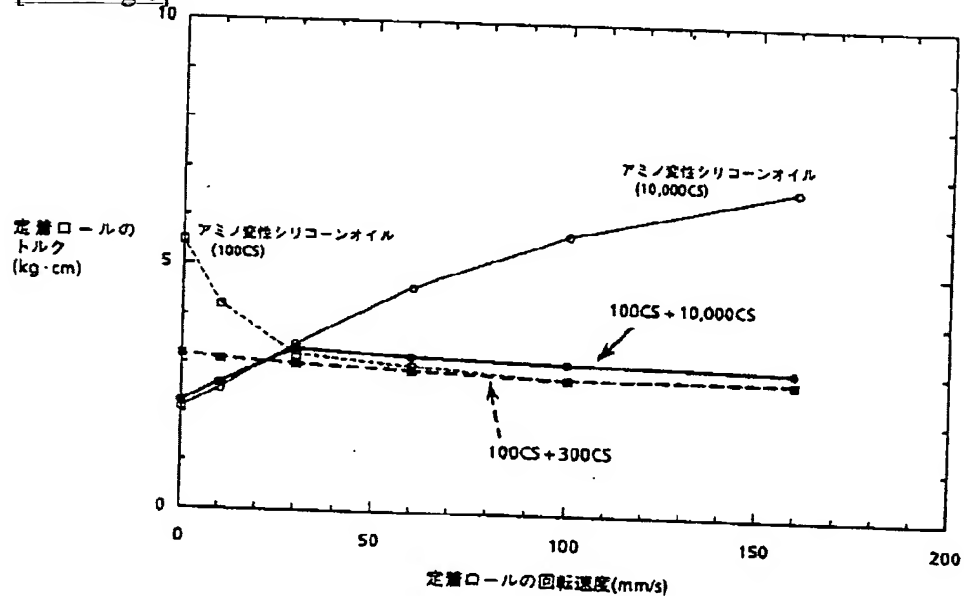
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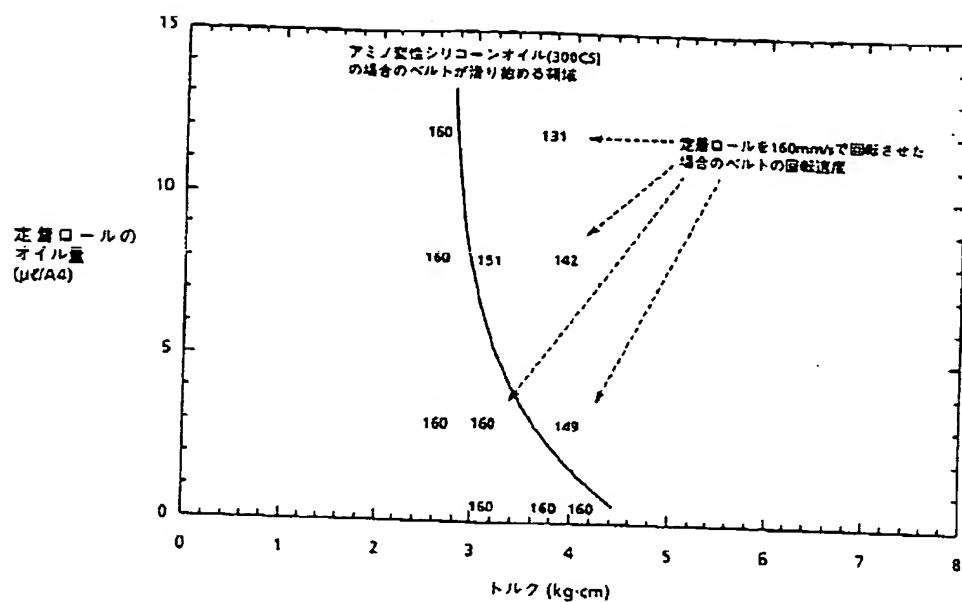
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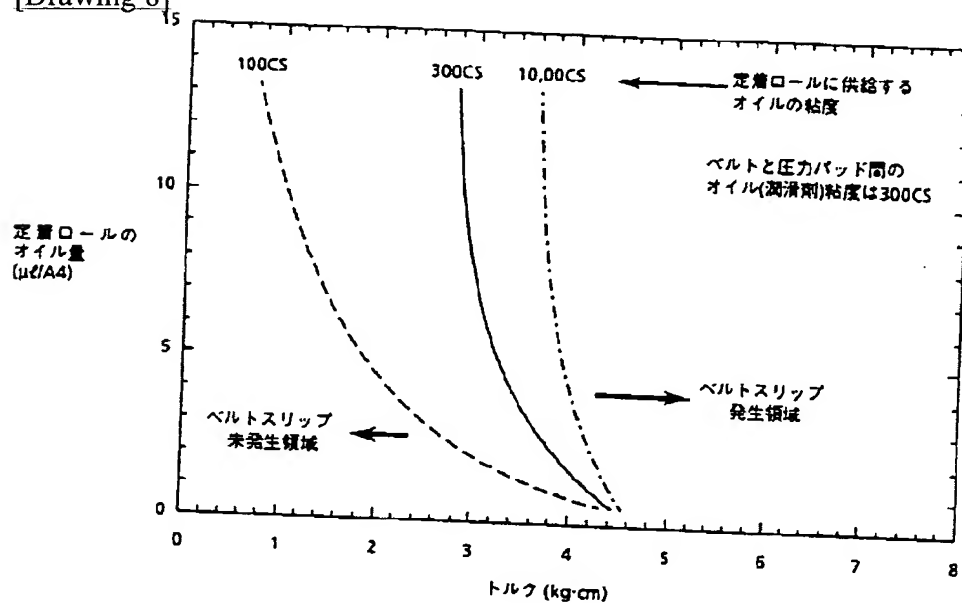
[Drawing 6]



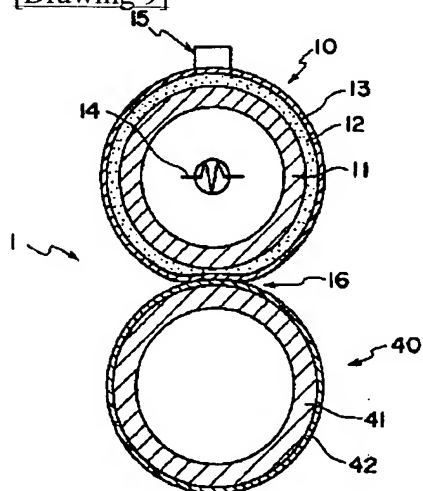
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]